The effect of mass change on the operation of the hydraulic system was also investigated. It turned out that in the range of mass changes from 10 to 100 (other parameters remained unchanged), the system operates mainly in the periodic mode. More detailed approximate ranges of modes are shown in table 1.

Table 1 - Changing modes of the hydraulic system when changing mass

The range of *m*	10-55	55-70	70-90	90-100
Mode	Periodic	Almost periodic	Doubling of period	Periodic

Conclusions. The study revealed the dependence of the modes of operation of the hammer on the values of the parameters of its mathematical model. It is revealed that at nominal parameters the hydro-impulse system operates in almost-periodic mode. When the dissipation coefficient increases, the dynamics of the device is periodic, when the frequency of oscillations in the system coincides with the frequency of external action. When the coefficient of dissipation is reduced, bifurcation of the doubling of the period is observed. Also, an important feature of this system is the possibility of a mode of deterministic chaos at certain values of the coefficient of dissipation. As the study showed, when the value of the consolidated mass changes, the system operates in periodic mode or in double period mode, or it operates in almost periodic mode. The above mentioned characteristics of the model can be useful for the design of hydro-pulse systems and for the choice of modes of their operation.

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ECONOMIC EVALUATION OF IMPLEMENTATION ENERGY-SAVING TECHNOLOGIES ON THE ENTERPRISES FROM PRODUCTION CERAMIC BRICK

Annotation. *Considered the recommendations of economic evaluation of the implementation of energy-saving technologies in brick factories. The process of ceramic brick production requires considerable energy and raw material resources and is quite energy intensive.*

Drying and firing of bricks are the most energy intensive.It is determined that the basic criteria of production efficiency are taken into account when developing and implementing energy-efficient brick drying technologies: material properties, duration of the drying process, heat consumption, number of man-hours, cost of drying and the possibility of automation.For the implementation and use of innovative technologies at brick enterprises it is advisable to determine energy efficiency, which determines the cost of energy resources for their rational use.It is established that the energy efficiency factor is an important indicator of determining the energy efficiency of innovative technologies. The total energy consumption of the resources expended for the production of bricks should include the energy intensity of raw materials, labor, depreciation of equipment, energy intensity of equipment and fuel and energy resources.

Determining energy efficiency at brick factories will help reduce the use of energy resources, reduce the cost of bricks, increase the profitability and energy independence of the enterprise.

Keywords:*Economic evaluation, energy efficiency, energy saving technologies, brick, brick factory, production, technology, energy intensity.*

Анотація*Розглянуто рекомендації економічної оцінки впровадження енергозберігаючих технологій на цегельних заводах. Процес виробництва керамічної цегли потребує значних енергетичних та сировинних ресурсів і є досить енергоємним процесом. Найбільш енергоємним вважається сушіння та випал цегли. Визначено, що при розробці і впровадження енергозберігаючих технологій сушіння цегли необхідно враховувати основні критерії ефективності виробництва: властивості матеріалу, тривалість процесу сушіння, витрати теплової енергії, кількість людино-годин, вартість сушіння та можливість автоматизації. Для впровадження і використання інноваційних технологій на цегельних підприємства доцільно визначати енергетичну ефективність, яка визначає витрати енергетичних ресурсів для раціонального їх використання. Встановлено, що коефіцієнт енергетичної ефективності є важливим показником визначення енергетичної ефективності інноваційних технологій. Загальна енергоємність ресурсів затрачених для виробництва цегли має включати енергоємність сировини і матеріалів, робочої сили, амортизацію обладнання, енергоємність устаткування та паливно-енергетичні ресурси.*

Визначення енергетичної ефективності на цегельних заводах буде сприяти зменшенню використання енергетичних ресурсів, зниженню собівартості цегли, підвищенню прибутковості та енергетичної незалежності підприємства.

Ключові слова:*Економічна оцінка, енергетична ефективність, енергозберігаючі технології , цегла, цегельний завод, виробництво, технологія, енергоємність.*

Introduction. Effective performance of enterprises in market conditions is closely link to the level of use of natural resources. In an economic crisis, energy savings are need, so the production activity of enterprises should be focus on the use of energy and resource-saving technologies.

Irrational use of natural resources, increasing consumption of energy resources have led to the fact that the issue of energy savings and their rational use have affected all industries, including the production of building materials [1]. The production of construction bricks is one of the powerful consumers of fuel and energy. The specific production costs of 1 thousand bricks are: steam - 670 kg, electricity - 36 kW / h, sand - 2.3 m^3, lime - 440 kg. Material costs per 1 m^3 of concrete mix are: cement - 280 kg, sand - 700 kg, gravel - 1250 kg, water 70 kg [1].

The process of ceramic brick production requires considerable energy and raw materials resources and is quite energy intensive production. Therefore, the relevance of the introduction of resource-saving technologies at such enterprises will help to reduce gas, energy, reduce the unit cost of production and reduce the anthropogenic load on the environment [1].

Aim. The purpose of the study is to evaluate the energy and economic potential of ceramic brick enterprises.

Material and methods. An energetic way of analyzing the process of ceramic brick production

Results. Production of ceramic bricks today is characterized by a shortage of fuel and energy resources and a decrease in stocks of quality raw materials. Therefore, it is important and important for the production process to use rational technology that will involve in the production process any clay raw materials and ensure low-cost, energy-efficient, cost-effective and quality products.

The production of ceramic bricks by firing is considered to be quite energy-intensive and requires the use of a considerable amount of natural resources, including batch preparation, molding, drying and firing of bricks. Drying and firing of bricks are the most energy intensive. Natural drying is long-lasting and not cost-effective, it also depends on natural conditions, which are often unfavorable in Ukraine and do not allow the enterprise to work all year long. Artificial drying requires significant fuel and electricity costs, which significantly affects the cost of the finished product, as well as the significant capital investment required for the construction of drying facilities. However, artificial drying is more effective than natural in terms of the duration of the drying process. On average, throughout the industry, the duration of drying of clay bricks is 44-45 hours in tunnels, 75-80 hours in chamber dryers. The term of natural drying is 3-15 days [2].

According to the technological requirements of drying bricks to obtain quality products of the dryer must provide the desired performance with the optimal drying regime and the ability to flexibly regulate the production process. The most progressive are tunnel and conveyor dryers with automated movement of bricks.

For good product drying, it is important to consider the initial and final values of the tunnel dryer temperature, the relative humidity of the bricks and the drying time.

When designing and implementing energy-efficient brick-drying technologies, it is necessary to take into account the basic production efficiency criteria: material properties, duration of the drying process, thermal energy consumption, number of man-hours, cost of drying and the possibility of automation.

For the introduction and use of innovative technologies at brick factories, it is advisable to determine energy efficiency, which determines the cost of energy resources for their rational use expressed in energy units.

The energy efficiency of technologies is substantiated by the main indicators that characterize the level of utilization of production potential and contribute to the identification of energy saving reserves and the definition of resource-saving technology. These indicators include energy efficiency ratio, unit energy consumption and total energy production output.

Energy efficiency is an important indicator of the energy efficiency of the technologies used and is defined as the ratio of useful energy to total energy. The economic literature presents all types of production costs that can be defined in energy equivalents.

For brick production, energy balance is determined in accordance with the law of energy conservation in accordance with the law of energy conservation, which characterizes the level of use of total energy resources in the production of products [3].

Energy balance can be determined by the formula:

$$W_{tot} = W_o + \Delta W \tag{1}$$

whereW_{tot} – total energy consumption of energy resources used in the production process at a brick factory;

W_o– useful consumed energy;

ΔW - the sum of unproductive energy losses of the resources used that create the energy load.

$$W_o = 0{,}24 \cdot m \cdot N \cdot \Delta t \cdot C, \tag{2}$$

where m -mass of bricks;
N - amount of bricks;
Δt - temperature difference;
C - specific heat capacity of moisture of the brick.

The total energy consumption of resources W_{tot}, the amount spent on the production of bricks should include the energy intensity of raw materials, labor, depreciation of equipment, energy-intensive equipment and fuel and energy resources, can be determined by the formula:

$$W_{tot} = \omega_1 + \omega_2 + \omega_3 + \omega_4 + \omega_5, Дж \quad (3)$$

Whereω_1– енергоємність сировини і матеріалів;
ω_2 – energy intensity of labor reproduction;
ω_3 – energy intensity of depreciation deductions of building structures and equipment;
ω_4 - energy intensity of fuel and energy resources;
ω_5 - energy intensity of equipment.

The energy efficiency ratio of brick production is characterized by the relative energy intensity of the technology and is determined by the ratio of useful energy consumed for the strength and reliability of the brick to the total energy expended in the production process:

$$\varepsilon = \frac{W_O}{W_{tot}}. \quad (4)$$

Conclusions. Outdated technologies, unsatisfactory condition of fixed assets of production, increase of cost of energy resources, lack of funds from owners indicate that the production potential of brick factories is not fully used. Therefore, is important the introduction of resource-saving technologies and taking into account the impact of the proposed energy components on the overall energy intensity of the products produced. In determining the energy assessment, it is also necessary to take into account the particularities of the technologies used, the climatic conditions, the location of the enterprise and the proximity to energy resources and the state of the environment.

Determining energy efficiency in the implementation of energy-saving technologies at brick-and-mortar enterprises will help reduce the use of energy resources and reduce the cost of finished products.

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